TITLE

ALARM MANAGEMENT SYSTEM AND METHOD THEREOF FOR NETWORK MANAGEMENT SYSTEM

CLAIM OF PRIORITY

This application claims priority to an application entitled *"SYSTEM AND METHOD FOR MANAGING ALARM IN NETWORK MANAGEMENT SYSTEM"* filed in the Korean Industrial Property Office on December 1, 2000 and assigned Serial No. 2000-72604, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Technical Field

The present invention relates generally to a network management system (NMS), and in particular, to a system and method for storing alarm information generated from a network and transferring the alarm information to a plurality of alarm managers.

Related Art

A network management system can monitor the state of a communication network all the time to maintain the network in an optimal state and can collect network state information, alarm information, and traffic data. When network alarm information is not handled efficiently, there can be inconvenience and difficulty.

1   There is a need to efficiently handle network alarm information. Exemplars of recent

2   efforts include U.S. Patent No. 6,040,770 to Britton, entitled *COMMUNICATION PATH*

3   *INTEGRITY SUPERVISION IN A NETWORK SYSTEM FOR AUTOMATIC ALARM DATA*

4   *COMMUNICATION*, issued on March 21, 2000, U.S. Patent No.5,621,383 to Yoshiyama,

5   entitled *RING NETWORK SYSTEM CAPABLE OF DETECTING AN ALARM IN EACH NODE*,

6   issued on April 15, 1997, U.S. Patent No.6,064,304 to Arrowsmith *et al.*, entitled *METHOD*

7   *AND APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN A DISTRIBUTED*

8   *NETWORK MANAGEMENT ENVIRONMENT*, issued on May 16, 2000, U.S. Patent

9   No.6,057,757 to Arrowsmith *et al.*, entitled *METHOD AND APPARATUS FOR POLICY-BASED*

10   *ALARM NOTIFICATION IN A DISTRIBUTED NETWORK MANAGEMENT ENVIRONMENT*,

11   issued on May 2, 2000, U.S. Patent No. 5,777,549 to Arrowsmith *et al.*, entitled *METHOD AND*

12   *APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN A DISTRIBUTED NETWORK*

13   *MANAGEMENT ENVIRONMENT*, issued on July 7, 1998, U.S. Patent No. 5,696,486 to Poliquin

14   *et al.*, entitled *METHOD AND APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN*

15   *A DISTRIBUTED NETWORK MANAGEMENT ENVIRONMENT*, issued on December 9, 1997,

16   U.S. Patent No.5,768,501 to Lewis, entitled *METHOD AND APPARATUS FOR INTER-*

17   *DOMAIN ALARM CORRELATION*, issued on June 16, 1998, and U.S. Patent No. 6,138,249 to

18   Nolet, entitled *METHOD AND APPARATUS FOR MONITORING COMPUTER SYSTEMS*

19   *DURING MANUFACTURING, TESTING AND IN THE FIELD*, issued on October 24, 2000.

20   While these recent efforts provide advantages, I note that they fail to adequately provide a

1   method for efficiently and conveniently handling network alarm information.

2   **SUMMARY OF THE INVENTION**

3   It is, therefore, an object of the present invention to provide an alarm management system

4   and a method thereof for a network management system, wherein alarm information generated

5   from a network is managed in multiple distributed tables.

6   It is another object of the present invention to provide a system and method for

7   transferring alarm information stored in multiple distributed tables among alarm managers by

8   broadcasting and polling.

9   To achieve the above objects and others, there is provided an alarm management system

10   and a method thereof in a network management system. According to one aspect of the present

11   invention, a management information system (MIS) notifies an alarm management host computer

12   that an alarm is generated from a network in the alarm management system. The alarm

13   management host computer manages the alarm information received from the management

14   information system. A plurality of alarm managers are connected to the alarm management host

15   computer. The alarm management host computer has an uncleared alarm table storage for

16   storing uncleared alarm information, a cleared alarm table storage for storing cleared alarm

17   information, and an alarm management processor for controlling the generated alarm information

18   to be stored in the uncleared alarm table storage, to be cleared from the uncleared alarm table

1 storage when the alarm is released, and then to be stored in the cleared alarm table storage.

2 According to another aspect of the present invention, an alarm management processor

3 makes an uncleared alarm table for storing alarm information that was generated from a network

4 and is not cleared yet and a cleared alarm table for storing cleared alarm information in the alarm

5 management method. Then, the alarm management processor makes a plurality of listener tables

6 corresponding to alarm managers connected to the alarm management processor and registers the

7 listener tables in a broadcasting list table. Upon generation of alarm information from a network,

8 the alarm management processor stores alarm information in the uncleared alarm table and the

9 listener tables registered in the broadcasting list table. The alarm managers read the alarm

10 information from the listener tables. When the alarm is released, the alarm management

11 processor clears the alarm information from the uncleared alarm table and stores the alarm

12 information in the cleared alarm table.

13 To achieve these and other objects in accordance with the principles of the present

14 invention, as embodied and broadly described, the present invention provides an apparatus,

15 comprising: a management information system outputting alarm information corresponding to an

16 alarm event and outputting an alarm clear signal corresponding to an end of said alarm event; an

17 alarm management host receiving said alarm information, said host having a broadcasting list

18 data table, said host having an alarm database including a first data table and a second data table,

19 said host having a plurality of memory spaces and a plurality of listener tables; a processor being

1   coupled to said host, said processor storing said alarm information in said first data table when

2   said alarm information is received by said host, said processor removing said alarm information

3   from said first data table and storing said alarm information in said second data table when said

4   alarm event is cleared, said alarm event being cleared when said alarm clear signal is output; and

5   a plurality of alarm managers being connected to said host, said plurality of alarm managers

6   including a first alarm manager, said listener tables including a first listener table corresponding

7   to said first alarm manager, each of said listener tables having a unique name listed in said

8   broadcasting list data table, said first listener table having a first unique name; said processor

9   storing said alarm information in each of said listener tables listed in said broadcasting list data

10   table; after said storing of said alarm information in said listener tables is completed, said alarm

11   managers reading said alarm information stored in said respective listener tables; when said

12   reading of said alarm information is performed, said alarm managers performing at least one

13   selected from among displaying said alarm information, printing said alarm information,

14   transmitting an e-mail message including said alarm information, transmitting a pager message

15   including said alarm information, and transmitting a facsimile message including said alarm

16   information; when said reading of said alarm information is performed, said alarm managers

17   removing said alarm information from said listener tables to prevent re-reading of said alarm

18   information; when said management information system performs said outputting of said alarm

19   clear signal, said processor performing said removing of said alarm information from said first

20   data table and performing said storing of said alarm information in said second data table.

1   To achieve these and other objects in accordance with the principles of the present

2   invention, as embodied and broadly described, the present invention provides a method,

3   comprising: outputting alarm information corresponding to an alarm event and outputting an

4   alarm clear signal corresponding to an end of said alarm event, said outputting being performed

5   by a network; receiving said alarm information, said receiving being performed by a host, said

6   host having a broadcasting list data table, a plurality of memory spaces, a plurality of listener

7   tables, and an alarm database including a first data table and a second data table; when said alarm

8   information is received by said host, storing said alarm information in said first data table; when

9   said alarm event is cleared, removing said alarm information from said first data table and storing

10   said alarm information in said second data table, said alarm event being cleared in response to

11   said outputting of said alarm clear signal; connecting a plurality of alarm managers to said host,

12   said plurality of alarm managers including a first alarm manager, said listener tables including a

13   first listener table corresponding to said first alarm manager, each of said listener tables having a

14   unique name listed in said broadcasting list data table, said first listener table having a first

15   unique name; storing said alarm information in each of said listener tables listed in said

16   broadcasting list data table; after said storing of said alarm information in said listener tables is

17   completed, reading said alarm information stored in said listener tables, said reading of said

18   alarm information stored in said listener tables corresponding to each one of said respective

19   alarm managers reading said alarm information stored in each one of said respective listener

20   tables; when said reading of said alarm information is performed by said alarm managers,

21   performing at least one selected from among displaying said alarm information, printing said

1   alarm information, transmitting an e-mail message including said alarm information, transmitting

2   a pager message including said alarm information, and transmitting a facsimile message

3   including said alarm information; when said reading of said alarm information is performed,

4   removing said alarm information from said listener tables to prevent re-reading of said alarm

5   information; and when said management information system performs said outputting of said

6   alarm clear signal, performing said removing of said alarm information from said first data table

7   and performing said storing of said alarm information in said second data table.

8   To achieve these and other objects in accordance with the principles of the present

9   invention, as embodied and broadly described, the present invention provides an alarm

10   management method for a network management system, comprising the steps of: making an

11   uncleared alarm table for storing alarm information that is generated from a network and that is

12   not cleared, and making a cleared alarm table for storing alarm information that is cleared;

13   storing first alarm information in the uncleared alarm table when the first alarm information is

14   generated from the network, said first alarm information corresponding to an alarm event; and

15   when the alarm event ends, removing said first alarm information from the uncleared alarm table

16   and storing the first alarm information in the cleared alarm table.

17   To achieve these and other objects in accordance with the principles of the present

18   invention, as embodied and broadly described, the present invention provides an alarm

19   management method for managing an alarm in a network, said method comprising: creating a

1   plurality of listener data tables for storing information, each one of said listener data tables

2   corresponding to one respective alarm manager selected from among a plurality of alarm

3   managers, each one of said listener data tables having a unique name; detecting whether said

4   alarm managers are operating normally; registering in a broadcasting list data table said unique

5   names identifying said listener data tables corresponding to said alarm managers that are detected

6   to be operating normally; when an alarm event is generated in said network, storing first alarm

7   information in said listener data tables corresponding to said names registered in said

8   broadcasting list data table; and reading said first alarm information from said listener data tables

9   by said corresponding alarm managers.

10   To achieve these and other objects in accordance with the principles of the present

11   invention, as embodied and broadly described, the present invention provides an alarm

12   management method for an alarm management processor connected to a plurality of alarm

13   managers, comprising the steps of: making an uncleared alarm table for storing alarm

14   information corresponding to an alarm event that is generated from a network and that is not

15   cleared, and making a cleared alarm table for storing alarm information corresponding to an

16   alarm event that is cleared; making a plurality of listener tables corresponding to the alarm

17   managers; registering the listener tables in a broadcasting list table; storing alarm information in

18   the uncleared alarm table when the alarm event is generated from the network; storing the alarm

19   information in the listener tables registered in the broadcasting list table; reading the alarm

20   information from the listener tables, said reading being performed by the alarm managers; and

1   when the alarm event is released, clearing the alarm information from the uncleared alarm table

2   and storing the alarm information in the cleared alarm table.

3   To achieve these and other objects in accordance with the principles of the present

4   invention, as embodied and broadly described, the present invention provides an apparatus for

5   managing an alarm event occurring in a network, said system comprising: a management

6   information system outputting alarm information corresponding to an alarm event; an alarm

7   management host computer managing said alarm information received from said management

8   information system; and a plurality of alarm managers being connected to said alarm

9   management host computer, said plurality of alarm managers reading said alarm information

10   when said alarm information is not cleared, said plurality of alarm managers including a first

11   alarm manager; said alarm management host computer having a first data table for storing said

12   alarm information when said alarm information is not cleared, a second data table for storing said

13   alarm information when said alarm information is cleared, said alarm management host computer

14   storing said alarm information in said first data table when said alarm information is not cleared,

15   said alarm management host computer removing said alarm information from said first data table

16   and storing said alarm information in said second data table when said alarm information is

17   cleared, said alarm information being cleared when said alarm event ends.

18   The present invention is more specifically described in the following paragraphs by

19   reference to the drawings attached only by way of example. Other advantages and features will

1 become apparent from the following description and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

3 In the accompanying drawings, which are incorporated in and constitute a part of this

4 specification, embodiments of the invention are illustrated, which, together with a general

5 description of the invention given above, and the detailed description given below, serve to

6 exemplify the principles of this invention.

7 FIG. 1 is a block diagram of an alarm management system;

8 FIG. 2 is a block diagram of an alarm management system, in accordance with the

9 principles of the present invention;

10 FIG. 3 is a flowchart illustrating an alarm management operation, in accordance with the

11 principles of the present invention;

12 FIG. 4 is a detailed flowchart illustrating a recording and reading operation in tables, in

13 accordance with the principles of the present invention; and

14 FIG. 5 is a flowchart illustrating a recording and reading operation in listener tables, in

15 accordance with the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

17 While the present invention will be described more fully hereinafter with reference to the

18 accompanying drawings, in which preferred embodiments of the present invention are shown, it

19 is to be understood at the outset of the description which follows that persons of skill in the

1   appropriate arts may modify the invention here described while still achieving the favorable

2   results of this invention. Accordingly, the description which follows is to be understood as being

3   a broad, teaching disclosure directed to persons of skill in the appropriate arts, and not as limiting

4   upon the present invention.

5   In the interest of clarity, not all features of an actual implementation are described. In the

6   following description, well-known functions or constructions are not described in detail since

7   they would obscure the invention in unnecessary detail. It will be appreciated that in the

8   development of any actual embodiment numerous implementation-specific decisions must be

9   made to achieve the developers' specific goals, such as compliance with system-related and

10   business-related constraints, which will vary from one implementation to another. Moreover, it

11   will be appreciated that such a development effort might be complex and time-consuming, but

12   would nevertheless be a routine undertaking for those of ordinary skill having the benefit of this

13   disclosure.

14   A network alarm management system stores plural pieces of alarm information generated

15   from the network and transfers the alarm information to a plurality of alarm management

16   computers connected to the network alarm management system.

17   FIG. 1 is a block diagram of a network alarm management system. Referring to FIG. 1, a

18   computer-based management information system (MIS) 110 collects state information generated

1   from a network. The management information system 110 is a system that includes computer

2   hardware, software, data, procedures, and people as its components, for processing data

3   generated from the network and produces diverse pieces of information. Especially, upon

4   notification of generation of an alarm event from the management information system 110, an

5   alarm management processor 120 of an alarm management host computer 100 stores information

6   about the alarm event in a predetermined form in an alarm database 130 formatted in a single

7   structural table. A plurality of alarm managers 140 to 144 displays uncleared alarm information

8   in real time, referring to the alarm database 130. An alarm event can be an error that occurs

9   during a data transmission, a quantity of errors exceeding a predetermined amount, a network

10   component failing to respond to polling, or any other type of fault condition.

11   In the above alarm management method, cleared alarm information and uncleared alarm

12   information are stored without discrimination in a single alarm table. Therefore, when an alarm

13   is cleared, an operator must clear corresponding alarm information referring to the entire alarm

14   table, expending much effort and time.

15   The operation of many alarm managers causes heavy load on the single alarm table when

16   they refer to the table. Consequently, the performance of the alarm managers is remarkably

17   decreased and an alarm history is reviewed at a lower speed. In addition, since all the alarm

18   managers share the single alarm table, an alarm management application program should be

19   developed to search the alarm table every time a new NMS is implemented.

1   FIG. 2 is a block diagram of an alarm management system according to the present

2   invention. Referring to FIG. 2, an alarm management host computer 200 is a workstation for

3   managing a network, including an alarm management processor 220, a broadcasting list table

4   230, an alarm database 240, and a plurality of listener tables 250 to 253.

5   The alarm management processor 220 operates according to an alarm management

6   application program being a daemon application program. As known, a daemon is a resident

7   program that executes computer system-associated operations in the background. That is, when a

8   task to be processed occurs, the alarm management daemon is automatically invoked from the

9   background and implements the task. A daemon is a program that is not invoked explicitly, but

10   lies dormant waiting for same condition to occur.

11   The alarm database 240 of a multiple distributed table structure includes an alarm

12   identifier (ID) table 241, an uncleared alarm table 243, and a cleared alarm table 245. The alarm

13   management processor 220 of the host computer 200 stores alarm information that was generated

14   from the network and is not cleared yet in the uncleared alarm table 243, and if the alarm

15   information is cleared, it clears the alarm information from the uncleared alarm table 243 and

16   stores the alarm information in the cleared alarm table 245.

17   The alarm management processor 220 is connected to workstations, personal computers

18   (PCs), or a plurality of alarm managers 260 to 263 that run in an application program of the

1   alarm management processor 220 in order to support distributed alarm management of plural

2   operators. Unless the alarm managers 260 to 263 read alarm information from the uncleared

3   alarm table 243 at a synchronous time, some alarm managers may read cleared alarm information

4   earlier and other alarm managers may read only uncleared alarm information later. In this case,

5   the alarm managers may have different alarm information.

6   To prevent this problem, the alarm managers 260 to 263 each secure unique alarm

7   information sensing areas, listener tables 250 to 253. The names of the listener tables 250 to 253

8   are registered in the broadcasting list table 230. Alarm information generated from the network

9   is stored both the uncleared alarm table 243 and the listener tables 250 to 253 at the same time.

10   The alarm managers 260 to 263 each read alarm information from their respective listener tables

11   250 to 253.

12   The alarm managers 260 to 263 can be configured to perform different tasks. The alarm

13   managers 260 to 263 can display the alarm information that was read from the listener tables 250

14   to 253, can create e-mail messages containing the alarm information and transmit those e-mail

15   messages over the Internet (not shown) or over other networks (not shown) or to a personal

16   digital assistant (PDA) (not shown) or to other electronic devices (not shown), can transmit the

17   alarm information in a fax message to a fax machine 510, and can transmit the alarm information

18   in a pager message to a pager 500. For example, an operator at alarm manager 260 can press a

19   key (not shown) to manually request that alarm manager 260 send a fax message to fax machine

1   510, using a modem (not shown) in alarm manager 260. Also, for example, the alarm manager

2   261 can be pre-programmed to send the alarm information to pager 500.

3   FIG. 3 is a flowchart illustrating an alarm management operation according to the present

4   invention. Referring to FIG. 3, the alarm management processor 220 makes the uncleared alarm

5   table 243 and the cleared alarm table 245 within the alarm database 240 in step S110. Since the

6   number of uncleared alarms is normally smaller than that of cleared alarms, the uncleared alarm

7   table 243 should be smaller than the cleared alarm table 245.

8   In S120, the alarm managers 260 to 263 connected to the alarm management host

9   computer 200 secure memory space for use as listener tables in the host computer 200 using their

10   process identifiers (IDs) and generate the listener tables 250 to 253. In S130, the alarm managers

11   260 to 263 store the names of their listener tables 250 to 253 in the broadcasting list table 230.

12   For example, the names of the listener tables 250 to 253 can be the process identifiers of the

13   alarm managers 260 to 263. If one of the alarm managers 260 to 263 is inoperative, the name of

14   its listener table is cleared from the broadcasting list table 230.

15   If an alarm is generated from the network, the alarm management processor 220 stores

16   information about the alarm in the uncleared alarm table 243 in S140. The step of S140 will be

17   described in detail hereinbelow.

1   Upon generation of an alarm from the network, the management information system

2   (MIS) 110 transmits an alarm generation event message representing generation of the alarm to

3   the host computer 200. An alarm event message generated from the management information

4   system (MIS) 210 typically includes the following fields, as shown in Table 1 below.

5   **<Table 1>**

6   Information fields of the alarm event message

dn	alarm position
event type	alarm type
severity	alarm level
probable cause	alarm cause
additional text	alarm additional information
event time	alarm generation time

13   The alarm management processor 220 parses the alarm generation event message

14   received from the management information system (MIS)210 and generates alarm information in

15   a predetermined form. Here, the alarm management processor 220 checks unused alarm

16   identifiers (IDs) referring to the alarm identifier (ID) table 241 having a plurality of alarm

17   identifiers stored therein to discriminate alarms generated from the network, assigns an unused

18   alarm identifier to the alarm information, and stores the alarm information in the uncleared alarm

19   table 243.

20   In step S150, the alarm management processor 220 stores the alarm information in the

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1   listener tables 250 to 253. The step of S150 will be described in detail hereinbelow.

2   After generating the alarm information, the alarm management processor 220 checks

3   whether the alarm managers 260 to 263 with the listener tables 250 to 253 registered in the

4   broadcasting list table 230 each operate normally. If processor 220 sense that an abnormal alarm

5   manager exists, the name of its listener table is cleared from the broadcasting list table 230 in

6   order to prevent unnecessary storage of the alarm information in the listener table of the

7   abnormal alarm manager.

8   Then, the alarm management processor 220 simultaneously transmits all alarm

9   information to the registered listener tables 250 to 253 referring to the broadcasting list table 230.

10   Before the alarm information is stored in the listener tables 250 to 253, the alarm management

11   processor 220 sets the listener tables 250 to 253 to a lock mode so that the alarm managers 260 to

12   263 cannot access the listener tables 250 to 253 during recording the alarm information. If the

13   recording operation is completed, the alarm management processor 220 releases the listener

14   tables 250 to 253 from the lock mode to allow the alarm managers 260 to 263 to access the

15   listener tables 250 to 253.

16   In step S160, the alarm managers 260 to 263 check whether alarm information is stored in

17   their respective listener tables 250 to 253 periodically or when an operator requests. If the stored

18   alarm information exists, the alarm managers 260 to 263 read the alarm information, display or

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1   print the alarm information, and clear or remove the alarm information from the listener tables

2   250 to 253 to prevent re-reading of the alarm information. Also, the alarm managers can

3   transmit an e-mail message including the alarm information, transmit a pager message including

4   the alarm information to a pager 500, and transmit a fax message including the alarm information

5   to a remote fax machine 510.

6   If the alarm is released, the alarm management processor 220 clears the alarm information

7   from the uncleared alarm table 243 and stores the alarm information in the cleared alarm table

8   245 in step S170, which is described in detail below.

9   If the alarm is released in the network, the management information system (MIS) 210

10   transmits an alarm release event message representing release of the alarm to the alarm

11   management host computer 200. The alarm release event message has the field "severity" set to

12   "clear". The alarm management processor 220 parses the alarm release event message received

13   from the management information system 210, looks up alarm information with a corresponding

14   alarm identifier (ID) in the uncleared alarm table 243, automatically clears the alarm information

15   from the uncleared alarm table 243, and inserts the alarm information in the cleared alarm table

16   245.

17   Unless information about a cleared alarm is automatically cleared due to problems

18   including a line abnormality between the management information system (MIS) 210 and the

1   host computer 200, an operator can request the alarm management processor 220 to manually

2   clear the alarm information using the alarm managers 260 to 263. Upon the request of manual

3   clear, the alarm management processor 220 clears the alarm information from the uncleared

4   alarm table 243 and stores the alarm information in the cleared alarm table 245.

5   FIG. 4 is a flowchart illustrating a recording and reading operation in the tables according

6   to the present invention. Referring to FIG. 4, in step S01, upon receipt of an alarm generation

7   event message from the management information system, the alarm management processor stores

8   corresponding alarm information in a listener table 0001 (250) registered in the broadcasting list

9   table 230. A corresponding alarm manager reads the alarm information from the listener table by

10   polling periodically or every time an alarm is generated.

11   In step S02, upon receipt of an alarm clear event message from the management

12   information system, the alarm management processor 220 looks up corresponding alarm

13   information in the uncleared alarm table 243, clears the alarm information, and automatically

14   inserts the alarm information in the cleared alarm table 245. The alarm manager, especially

15   when it wants to review an alarm history, may monitor changes of alarm information in the

16   uncleared alarm table 243 and the cleared alarm table 245 and display them on a display.

17   In step S03, if the operation requests the alarm management processor 220 to manually

18   clear alarm information using the alarm manager, the alarm management processor 220 looks up

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1   the alarm information in the uncleared alarm table 243, clears it from the uncleared alarm table

2   243, and stores it in the cleared alarm table 245.

3   In step S04, when the alarm management procedure ends due to power-off of the

4   computer of the alarm manager or termination of its application program, the alarm manager

5   requests the alarm management processor 220 to clear its listener table before the procedure

6   ends. In response to the request, the alarm management processor 220 deletes the listener table.

7   FIG. 5 is a detailed flowchart illustrating a recording and reading operation in listener

8   tables according to the present invention. It is assumed here that the names of listener tables

9   registered in the broadcasting list table 230 are listener_0001, listener_0002, and listener_0003.

10   Referring to FIG. 5, the alarm management processor 220 sets listener table #0001 named

11   listener_0001 to a lock mode, records generated alarm information in listener table #0001, and

12   then releases it from the lock mode in step S11. The reason for the alarm management processor

13   to set listener table #0001 to the lock mode is to prevent alarm manager #0001 corresponding to

14   listener table #0001 from accessing listener table #0001 during recording of the alarm

15   information. In step S12, alarm manager #0001 sets listener table #0001 to the lock mode, reads

16   the alarm information from listener table #0001, and then releases it from the lock mode. The

17   reason for alarm manager #0001 to set listener table #0001 to the lock mode is to prevent the

18   alarm management processor 220 from accessing listener table #0001 during reading the alarm

1   information.

2   Similarly, the alarm management processor 220 sets listener tables #0002 and #0003 to

3   the lock mode, records the same alarm information in listener tables #0002 and #0003, and then

4   releases them from the lock mode in steps S13 and S15. In steps S14 and S16, alarm managers

5   #0002 and #0003 set listener tables #0002 and #0003 to the lock mode, read the alarm

6   information from listener tables #0002 and #0003, and then release them from the lock mode.

7   In accordance with the present invention as described above, alarm information is readily

8   looked up using distributed multiple tables for alarm management in a network management

9   system, thereby saving time and efforts of an operator. Since a plurality of alarm managers have

10   their respective listener tables, asynchronous access to alarm information is solved and load

11   during the access is decreased.

12   That is, the present invention is advantageous in that load is distributed due to distributed

13   management of alarm data, a decrease in an alarm information search speed caused when

14   accumulated alarm information reaches a certain level is prevented, heavy load during polling of

15   alarm data is overcome, the efficiency and speed of alarm history reviewing are increased, and

16   alarm managers can be managed by use of listener tables.

17   While the present invention has been illustrated by the description of embodiments

1   thereof, and while the embodiments have been described in considerable detail, it is not the

2   intention of the applicant to restrict or in any way limit the scope of the appended claims to such

3   detail. Additional advantages and modifications will readily appear to those skilled in the art.

4   Therefore, the invention in its broader aspects is not limited to the specific details, representative

5   apparatus and method, and illustrative examples shown and described. Accordingly, departures

6   may be made from such details without departing from the spirit or scope of the applicant's

7   general inventive concept.